24.914
Geographical variation in the phonetics and phonology of English - Transcription
Readings and assignments

• Assignment: Phonetic transcription exercise, due session 4
Geographical variation

• Languages are spoken differently in different geographical areas.

• Some examples

• We will survey variation in phonetics and phonology across dialects of English in the USA (and the UK).

• We will then explore explanations for properties of the observed patterns of variation based on theories about how sound change operates.

• First we need ways to describe and analyze the varieties that we find.
  ➢ Phonetic transcription
  ➢ Phonological analysis
Phonetic transcription

- A phonetic transcription system provides a useful means of recording speech.
- We will be using the International Phonetic Alphabet (IPA)
  - ‘The IPA is intended to be a set of symbols for representing all the possible sounds of the world’s languages.’ IPA (1990)
  - ‘There should be a separate letter for each distinctive sound’ *Aims and Principles* (1949)
Describing speech sounds

• In phonetic transcription and in phonological analysis, speech sounds are commonly described in terms of the way in which they are produced.

• Later we will see how to characterize some sounds in terms of measured acoustic properties.
Speech production system

- The speech production system comprises the lungs and the vocal tract.
Vowels

- Vowel sounds are usually voiced.
- They are all produced without any very narrow constriction of the vocal tract (not narrow enough to generate turbulent air flow).
- Vowel qualities are differentiated by the shape of the vocal tract, resulting from different positions of tongue and lips.

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Describing vowels

Four parameters:

- Height (high-mid-low)
- Backness (front-central-back)
- Lip rounding (rounded-unrounded)
- Tense-lax

We will see that judgments of height and backness generally reflect acoustic properties of vowels more directly than tongue body position.
Vowel height

[i] heed high
[ɪ] hid high (lax)
[ɛ] head mid
[æ] had low

[u] who’d high
[u] hood high (lax)
[ɑ] hod low or odd
Vowel height

[i]  heed  high
[ɨ]  hid   high (lax)
[ɛ]  head  mid
[æ]  had   low

[u]  who’d high
[ʊ]  hood  high (lax)
[a]  hod   low or odd
Vowel rounding

[i]  heed
[I]  hid
[ɛ]  head
[æ]  had

[ʌ]  hut

[u]  who’d  rounded
[u]  hood
[a]  hod/ odd  unrounded

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American English vowels

- Some American English vowels

<table>
<thead>
<tr>
<th></th>
<th>Front</th>
<th>Central</th>
<th>Back</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>tense</td>
<td>i</td>
<td>u</td>
</tr>
<tr>
<td></td>
<td>lax</td>
<td>i</td>
<td>u</td>
</tr>
<tr>
<td>Mid</td>
<td>higher</td>
<td>eɪ</td>
<td>oʊ</td>
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<tr>
<td></td>
<td>lower</td>
<td>e</td>
<td>ə</td>
</tr>
<tr>
<td>Low</td>
<td>æ</td>
<td></td>
<td>a</td>
</tr>
</tbody>
</table>

Diphthongs:


Unstressed: [ə] ‘attack’
Diphthongs

• Diphthongs are vowels that change quality during the duration of the vowel.

• Transcribed with vowel symbols indicating starting and ending qualities, e.g. [aɪ] *hide*.
  – Some sources use glides to transcribe the offsets of English diphthongs [aj] ([aɪ]), [ej] ([eɪ]), [ow] ([oʊ])
  – [j] is similar to [i] and [w] is similar to [u]

• In the vowels [eɪ] (*rate*) [oʊ] (*wrote*), the nuclei are mid [e, o], while the offglides are high.

• The monophthongs [e, o] are found in many languages (e.g. Spanish, Italian, Scottish English, Minnesota Eng.).
Tense vs. Lax Vowels

• Tense and lax vowels in English are distinguished more on phonological rather than phonetic grounds.

• Lax vowels cannot occur at the end of a word while tense vowels can.
  – *[si], *[sɛ], *[su], *[sæ]
  – By this criterion [ɔ] is not lax since it can occur at the end of words: [sɔ] saw. But many feature systems analyze [oʊ]/[ɔ] as a tense-lax pair.

• Phonetically, tense vowels are longer than most of the lax vowels, and in tense-lax pairs like [i-ɪ], [u-ʊ], [eɪ-ɛ] the tense vowel is higher and more peripheral on the front-back dimension.

• [e, o] are higher (or close) mid and [ɛ, ɔ] are lower (or open) mid.
Schwa [ə]

- [ə] is usually said to be a mid central unrounded vowel, but that’s not really how this symbols is used in the transcription of English.
- It is mainly used to transcribe short, unstressed vowels of contextually variable quality
  - *about* [əbawt], *pretend* [prətɛnd], *panda* [pændəə]
- [ʌ] is a lax mid central unrounded vowel
  - *but* [bʌt], *sun* [sʌn]
- The vowel at the end of words like *panda* and *comma* can be similar to [ʌ], although conventionally transcribed with [ə], but in most other contexts [ə] is not only shorter than [ʌ], but often much higher.
  - *abut* [əbʌt]
More vowels

- The IPA distinguishes the following vowel symbols:

![Vowel Symbols Diagram]

Notes:
- Close = high, Open = low
- The IPA says [a] is a low front vowel – we will call it central
- [ʌ] is officially a back vowel, but in transcription of English, it is conventionally used to transcribe a lower-mid central vowel (hut, bud)
More vowels

• In English, only back vowels are rounded [u, ʊ, ou, ɔ].
• It is common across languages for front vowels to be unrounded and for non-low back vowels to be rounded.
  – E.g. Spanish
    i  u
    e  o
    a
• But some languages have front rounded vowels as well
  – High front rounded [y], e.g. French une [yn]
  – Mid front rounded [ø], e.g. French bleu [blø]
• Non-low back unrounded vowels occur as well, e.g. the ‘u’ of Tokyo Japanese is high back unrounded [ɯ]
Geographical distribution of the *cot-caught* merger.

Figure by MIT OpenCourseWare. Adapted from the Linguistics Laboratory of the University of Pennsylvania.
Consonants

• Consonants differ from vowels in that they are produced with narrower constrictions of the vocal tract.

• Parameters for describing consonants:
  – Voicing: voiced or voiceless
  – Place of articulation: where the constriction is formed, and with what articulator.
  – Manner of articulation: how narrow the constriction is.
  – Oral/Nasal: whether the velum is lowered.
  – Lateral(/Central)
Place of articulation

- Specified in terms of the articulator that forms the consonant constriction and the location of the constriction.
### English consonants

<table>
<thead>
<tr>
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<th>bilabial</th>
<th>labiodental</th>
<th>dental</th>
<th>alveolar</th>
<th>alveopalatal</th>
<th>palatal</th>
<th>velar</th>
<th>glottal</th>
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<td>t d</td>
<td></td>
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<td>k g</td>
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<td>η</td>
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<td>f v</td>
<td>t̪ d̪</td>
<td>s z</td>
<td>ʃ ʒ</td>
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<td>liquid - lateral</td>
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<td>glide</td>
<td>w</td>
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<td>j</td>
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</tbody>
</table>

- It’s not clear where to put [ɹ] and [w] on the chart since [w] has two constrictions (labial and velar), and [ɹ] has various pronunciations.
More consonants

<table>
<thead>
<tr>
<th></th>
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<th>Dental</th>
<th>Alveolar</th>
<th>Post alveolar</th>
<th>Retroflex</th>
<th>Palatal</th>
<th>Velar</th>
<th>Uvular</th>
<th>Pharyngeal</th>
<th>Glottal</th>
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<tbody>
<tr>
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<td>b</td>
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<td>d</td>
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<td>q</td>
<td>c</td>
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<td>Nasal</td>
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<td>Tap or Flap</td>
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<td>f</td>
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<td>Fricative</td>
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<td>β</td>
<td>f</td>
<td>v</td>
<td>θ</td>
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<td>z</td>
<td>s</td>
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<td>x</td>
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<td>j</td>
<td>m</td>
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</table>

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

- [ɾ] tap (a.k.a flap) – butter, metal, medal
- [ʔ] glottal stop
Geographical variation in English

• English is spoken differently in different parts of the USA, UK, etc.

• We will survey variation in phonetics and phonology across dialects of English in the USA (and the UK).

• We will then explore explanations for properties of the observed patterns of variation based on theories about how sound change operates.
Geographical variation in English

- We can observe geographical variation in all aspects of languages, but for now we are focusing on phonetics and phonology.
  - Accent variation
- Cf. Lexical variation

- Syntactic variation, e.g. ‘The car needs repaired’, ‘The house needs painted’
Geographical variation in English

• Dialects of English can differ in all aspects of phonetics and phonology
  – Contrastive sounds (‘phonemes’)
    • How many
    • Basic phonetic realization
  – Allophonic variation in the realization of these sounds.
    • Including phonetic details such as patterns of coarticulation.
  – Restrictions on the distribution of contrasts
    • E.g. positional neutralization of contrasts
Variation in inventory of vowel contrasts

- Accents of English differ in the number of contrasting low/lower-mid back vowels.

- Most British accents contrasts three lower back vowels, e.g. Standard Southern British English (a.k.a. Received Pronunciation) /ɔ, ɔ, ɒ/

- Some N. American accents contrast two lower back vowels, e.g. Inland North (Detroit, Chicago etc).
  - [kʰɑt]/[kʰɑt] ‘cot’, [kʰɔt] ‘caught’
  - [dən]/[dan] ‘Don’, [dɔn] ‘dawn’

- Buffalo Chicago Kenosha
  - Also a difference in the phonetic realization [ɑ] vs. [a]
Variation in inventory of vowel contrasts

- Others have only one lower back vowel, e.g. the West.
  - \([kʰɑt] \text{‘cot, caught’}, [dɑn] \text{‘Don, dawn’}\)
  - Los Angeles ‘awful’
  - Los Angeles ‘thought’

www.dialectsarchive.com/california-1
www.dialectsarchive.com/california-4

Image by MIT OCW.
Adapted from the Linguistics Laboratory of the University of Pennsylvania.
Variation in inventory of vowel contrasts

• What are the differences between the grammars of these varieties of English?

Quick review of phonology:

• Phonological grammars map all logically possible input representations onto well-formed output representations.
  – Accounts for phonotactic restrictions
    • e.g. if phonology always maps /ɒ/ → [ɑ] (and doesn’t map any other sound onto [ɒ]), then words containing [ɒ] are ill-formed.
  – Accounts for alternations – the same morpheme can be mapped onto different pronunciations in different contexts.
    • E.g. /bɛt/ → [bɛt], /bɛt-ɪŋ/ → [bɛɾɪŋ]
• The mapping from input to output is specified by a ranked set of constraints (Optimality Theory)
Variation in inventory of vowel contrasts

• The mapping from input to output is specified by a ranked set of constraints (Optimality Theory)

• The output for a given input is the representation that best satisfies the set of constraints.

• There are two basic types of constraints:
  – Markedness constraints – penalize dispreferred output configurations
    • E.g. *[+low, +round] (violated by [p])
  – Correspondence constraints (a.k.a. faithfulness constraints) – require the output to be similar to the input (ideally identical).
    • E.g. IDENT(round) – corresponding input and output segments must have the same [round] specifications.
Variation in inventory of vowel contrasts

- Conflict between constraints is resolved by reference to the constraint ranking: the higher-ranked constraint prevails.
  - E.g. * [+low, +round] >> IDENT(round)

<table>
<thead>
<tr>
<th></th>
<th>/kʰɒt/</th>
<th>* [+low, +round]</th>
<th>IDENT(round)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>kʰɒt</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>kʰɑt</td>
<td></td>
<td>*</td>
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</tbody>
</table>

<table>
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<td>*!</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>kʰɑt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- No contrast between [ɔ] and [ɑ]
- in general only [ɑ] occurs.
Variation in inventory of vowel contrasts

- In general, a feature is contrastive in a context if faithfulness to that feature outranks all markedness constraints against a value of that feature occurring in that context.
- E.g. rounding contrast among low vowels [ɑ, ɒ], as in RP English:
  \[
  \text{IDENT(round)} \gg *[+\text{low}, +\text{round}]
  \]

<table>
<thead>
<tr>
<th></th>
<th>/kʰɒt/</th>
<th>IDENT(round)</th>
<th>*[+low,+round]</th>
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<tbody>
<tr>
<td>a.</td>
<td>kʰɒt</td>
<td></td>
<td>*</td>
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<tr>
<td>b.</td>
<td>kʰɑt</td>
<td>*!</td>
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<thead>
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<th></th>
<th>/kʰɑt/</th>
<th>IDENT(round)</th>
<th>*[+low,+round]</th>
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<tr>
<td>a.</td>
<td>kʰɒt</td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>kʰɑt</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

- No contrast between [ɒ] and [ɑ], only [ɑ] occurs:
  \[
  *[+\text{low}, +\text{round}] \gg \text{IDENT(round)}
  \]
Variation in inventory of vowel contrasts

• Identifying the constraints that regulate vowel inventories is an interesting (and hard) problem (e.g. Flemming 2004).

• For now, we will adopt simplistic markedness constraints:
  – *[+low, +round] – *ɒ, ɶ
  – *[-high, -tense, +round] – *ɔ, ʊ

  • Note we are using [tense] to distinguish [o] from [ɔ] in spite of the conflict with the use of [-tense] to group the vowels that cannot occur word-finally in English.

• Constraint rankings for RP, Inland North and West?
Variation in the phonetic realization of equivalent vowels

- \([\text{æ}]\) vs. \([\text{a}]\) in words like cot, Don, hot, lot, father
- \([\text{u}]\) vs. \([\text{ʉ}]\) – e.g. Detroit AAVE vs. S. California
- \([\text{ou}]\) vs. \([\text{ʌv}]\) – e.g. Detroit AAVE vs. SSBrE
  - /ou/ ‘fronting’ is also a characteristic of the Philadelphia, Baltimore and some Southern accents.

- Phonological analysis?
Variation in the distribution of contrasts

- In many Southern and African-American Vernacular English (AAVE) accents, the contrast between /ɪ/ and /ɛ/ is neutralized to [ɪ] before nasals.
  - ‘pin-pen merger’

<table>
<thead>
<tr>
<th>Word</th>
<th>Phonetic</th>
<th>Word</th>
<th>Phonetic</th>
<th>Word</th>
<th>Phonetic</th>
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</thead>
<tbody>
<tr>
<td>pit</td>
<td>pʰɪt</td>
<td>pin</td>
<td>pʰɪn</td>
<td>him</td>
<td>hɪm</td>
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<tr>
<td>pet</td>
<td>pʰɛt</td>
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<td>Rick</td>
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<td>many</td>
<td>'mɪni</td>
<td>length</td>
<td>lɪŋkθ</td>
</tr>
<tr>
<td>wreck</td>
<td>ɹɛk</td>
<td>mini</td>
<td>'mɪni</td>
<td></td>
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</tr>
</tbody>
</table>
Pin-pen merger

- Geographical distribution of the *pin-pen* merger
Pin-pen merger

General recipe for phonological analysis of contextual neutralization:
- Context-sensitive markedness >> ‘Faith’ >> Context-free markedness
- A simplistic analysis of the *pin-pen* merger:
  - *ɛ[+nasal] >> IDENT(high) >> *ɛ
  - Contrast between *[ɪ, ɛ]* before non-nasals:

<table>
<thead>
<tr>
<th>/pʰɪt/</th>
<th>*ɛ[+nasal]</th>
<th>IDENT(high)</th>
<th>*ɛ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. pʰɪt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. pʰɛt</td>
<td></td>
<td>*!</td>
<td>*</td>
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<tr>
<th>/pʰɛt/</th>
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<th>IDENT(high)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>a. pʰɪt</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. pʰɛt</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
Pin-pen merger

- A simplistic analysis of the *pin-pen* merger:
  - *ɛ[+nasal] >> IDENT(high) >> *ɛ
  - Neutralization of [ɪ, ɛ] before nasals:

<table>
<thead>
<tr>
<th></th>
<th>/pʰɪn/</th>
<th>*ɛ[+nasal]</th>
<th>IDENT(high)</th>
<th>*ɛ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>⬠ pʰɪn</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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<th>*ɛ[+nasal]</th>
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<tbody>
<tr>
<td>a.</td>
<td>⬠ pʰɪn</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
Patterns of distribution

• So far we have considered three patterns of distribution of a pair of sounds (or two sets of sounds):

  1. Contrast in all (relevant) contexts
     • e.g. RP [æ] vs. [ɒ]
  2. Positional neutralization – the sounds contrast in some contexts, but only one appears in other contexts.
     • e.g. pin-pen neutralization
  3. No contrast in any context – only one sound appears.
     • e.g. US [æ], *[ɒ]
• There is a variant of (3): No contrast, allophonic variation
  – One sounds appears in one context, the other appears elsewhere.
  – E.g. nasalized vowels before nasals, oral vowels elsewhere
Allophonic variation

• Allophonic variation can be derived from the following ranking schema:
  • Context-sensitive markedness >> Context-free markedness >> ‘Faith’
  • *ORALV-N >> *NASALV >> IDENT(nasal)
    – Only nasalized vowels preceding a nasal consonant

<table>
<thead>
<tr>
<th>/pʰɛn/</th>
<th>*ORALV-N</th>
<th>*NASALV</th>
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<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. pʰɛn</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>/pʰɛ̃n/</th>
<th>*ORALV-N</th>
<th>*NASALV</th>
<th>IDENT(nasal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. pʰɛn</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. pʰɛ̃n</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
Allophonic variation

- Allophonic variation can be derived from the following ranking schema:
- Context-sensitive markedness >> Context-free markedness >> ‘Faith’
- \(*_{\text{ORALV-N}} >> *_{\text{NASALV}} >> \text{IDENT(nasal)}\)
  - Only oral vowels elsewhere

<table>
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Patterns of distribution

- These four patterns of distribution follow can all be derived from the possible rankings of three types of constraints:
  - \textsc{Ident}(F) >> \textsc{MC-sensitive} >> \textsc{MC-free} \quad \text{Contrast in all contexts}
  - \textsc{Ident}(F) >> \textsc{MC-free} >> \textsc{MC-sensitive} \quad \text{No contrast}
  - \textsc{MC-free} >> \textsc{Ident}(F) >> \textsc{MC-sensitive} \quad \text{- only one sound appears}
  - \textsc{MC-sensitive} >> \textsc{MC-free} >> \textsc{Ident}(F) \quad \text{No contrast, allophonic variation}
  - \textsc{MC-sensitive} >> \textsc{Ident}(F) >> \textsc{MC-free} \quad \text{Contextual neutralization}